DOCUMENTATION REQUIREMENTS
Subsurface Drain - 606

I. Reference Materials

The following is a list of reference materials to be used in terrace design and construction.

a. Supplement to Engineering Field Manual - Chapters Two and Fourteen
b. King's Handbook showing use of Manning's Formula
c. Section IV Technical Guide, Practice Standard 606, Subsurface Drain
d. Hydrology Manual for North Dakota
e. County Soil Survey Report
f. North Dakota Construction and Material Specifications for Conservation Practices
g. Suitable Computer Software:

Hydraulics (e.g. Ohio Program)
Watershed Hydrology (e.g. EFM2, EFH2, TR55)
Excel Spreadsheet Hydrology (e.g. ND-ENG-12e)
Excel Spreadsheet Yardage (e.g. ND-ENG-1e)
Design (e.g. PRINSCO calculator, DRAIN-NASIS)

II. Site Investigation/Data Collection

The following is a list of items to be checked in the field:

a. Determine engineering job class
b. With the landowners, discuss present and future farming operations to determine type of subsurface drain, extent, depth, spacing
c. Check for buried utilities – North Dakota ONE-CALL
d. Adaptability of site (i.e. wetland considerations, topography)
e. Suitable outlet, existing or to be constructed (natural, grassed, tile)
f. Soils
g. Maintenance requirements

III. Design Surveys

1. Select approximate spacing and grade. Survey lines as needed to determine stable outlet grade. Approximate sizes, depths, and lengths can be obtained.
2. Design surveys of subsurface drains that are not complex may be combined with layout survey.
3. Complex layouts will require a topographic map of the area. Existing wetlands must be addressed PRIOR to final landowner decisions.
4. The design layout shall be recorded on field notes. The field notes shall show a good location sketch, with each subsurface drain, inlet, and main line (outlet) identified and numbered. Provide enough survey data in the field so that all drains and undergound appurtenances can be located in the future.

IV. Design Plans and Specifications

The steps in design are as follows:

1. Following Standard and Specification 606 – Subsurface Drain, Section IV, Technical Guide, determine:
   a. Soil series and type to determine hydraulic conductitivity
      (1) Soil Survey Report
      (2) NRCS Soil Scientist on-site
   b. Grade and depth, based on economics, used to help determine spacing.
   c. Record log of borings on Form ND-ENG-41 to show ground water, surface soil conditions, pervious and impervious layers, and other soil data pertinent to design and construction.
   d. Spacing (based on economics, depth, and soils)
      (1) Engineering Field Manual - Chapter 14
      (2) Section I - C Technical Guide

V. Material and Construction Requirements

A set of plans and specifications for construction shall be filed in the cooperator's file. The plans can be detailed on appropriate sized sheets. Two sets of plans and specifications will be given to the cooperator. The cooperator shall provide a set to the contractor.

The plans shall contain, as a minimum, the following:

1. Overall Plan View - May be superimposed on the location map. Show subsurface drains and number them.
2. Profile, grades - Show profile grade for each drain and main line.
3. Construction Notes - Add notes to clarify or furnish direction in construction.
4. Quantities - Estimates
5. Job Approval (NRCS personnel)

Construction specifications shall be provided with each set of plans. The North Dakota Construction and Material Specification for Conservation Practices shall be used for each item of work and material, as applicable or available. Additional specifications may need to be written to provide full material and installation instructions. A cover sheet and list of specifications shall be provided with the specifications.

VI. Layout and Installation Procedures

Layout surveys shall be recorded in loose-leaf or bound survey books. Set necessary centerlines or stakes for alignment and depth. Set grade stakes as needed to maintain proper elevations.

Survey notes shall be kept in the format as shown in Chapter 1, Engineering Field Manual, and/or Technical Release 62. Electronic survey notes will be documented in a format to allow complete checking by others. A bench mark shall be established and maintained.

VII. Checkout

1. Compliance checking - record in field notes.
   a. Survey and record profile (max. 50-foot intervals) each subsurface drain, mains and laterals in each field. Make a sketch map showing location of the tile lines.
   b. Record lengths of tile lines by size and kinds of tile. Lengths may be obtained by tape, chain, or wheel. State method of measurement.
   c. Show filter thickness and kind of material. Show method of covering tile joints.
   d. Locate and record horizontal distance between each drain and main line (outlet). Locate any surface inlets, locations and dimensions of manholes.
   e. Check adequacy of outlet protection, number of outlets, length, kind, and size of outlet pipe.
   f. Record vertical distance between invert of outlet pipe and normal water level in outlet ditch or stream.

2. "As-built" plans are a record of constructed facilities. Changes from design are to be superimposed in a different color or 2H pencil on the official file copy of the plans. On the "as-builts" show:
   a. Significant design changes. Significant changes in linear measurements or cut-fill quantities.
   b. Final quantities.
   c. Identify "as-builts" on plans with construction date, contractor and address. Statement of compliance on "as-built" - state the construction is complete according to plans and specifications. Date and sign by individual making determination.